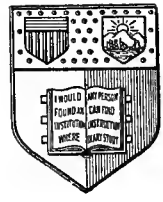

U. S. Department of Agriculture
WEATHER BUREAU.

INSTRUCTIONS

FOR USING

ARVIN'S WEIGHING RAIN AND SNOW GAUGE.

CIRCULAR E, INSTRUMENT ROOM.

WASHINGTON, D. C.:
WEATHER BUREAU.
1893.

U. S. Department of Agriculture,
WEATHER BUREAU.

INSTRUCTIONS

FOR USING

MARVIN'S WEIGHING RAIN AND SNOW GAUGE.

CIRCULAR E, INSTRUMENT ROOM.

WASHINGTON, D. C.:
WEATHER BUREAU.
1893.

INSTRUCTIONS FOR USING MARVIN'S WEIGHING RAIN AND SNOW GAUGE.

1. It is quite evident that at once the simplest and most accurate method of measuring snow is by weighing the quantity collected within or upon any given receptacle. No loss need occur in this method either from evaporation or by melting processes, or in the wetting of conducting tubes, etc. Even the bowl of the gauge may be dispensed with, allowing the precipitation to pass at once into the receiving vessel. The method is equally applicable to registration of rainfall.

2. The form of gauge herein described is constructed to weigh and record precipitation in the form of either rain or snow. The action is intermittent, but by steps which represent only one one-thousandth inch of rainfall, and the record is therefore practically continuous.

3. *Description.*—The apparatus consists of two parts, (1) the weighing gauge and (2) the recorder, or register. These parts are connected by three insulated copper wires, one of which is opened and a few cells of electrical battery inserted.

4. The action of the apparatus is as follows: The receiving vessel into which the precipitation falls and is retained rests upon ordinary weighing mechanisms or scales, so made that the equilibrium of the balance, whenever disturbed, as by the fall into the receptacle of small quantities of water, is immediately restored by the automatic movement of a sliding weight along the balance beam, a corresponding movement taking place in the register pen. The fall of water into the receiver depresses the beam, causing electrical contact to be made with a spring and sending a current through a magnet on the balance, the action of which moves the counterweight and also sends the current through the magnet on the register, thus actuating the recording pen.

5. *Details.*—Fig. 1 represents the weighing mechanisms with the galvanized iron cover removed and shown in reduced size in the upper left-hand corner. The receiving vessel consists of a large copper can 8½ inches in diameter and 11 inches high, the large size being necessary for the collection of snowfall. The can is shown in outline by dotted lines. The sliding counterpoise is seen in Fig. 1 at the extreme left end of the balance beam. The automatic movement of the counterweight is effected by the action of a long screw set parallel to the beam. A half nut on the carriage of the counterweight engages the threads of the screw and can be disengaged by hand so as to set the counterweight when adjusting the gauge after rainfall.

6. The magnet controlling the equilibrium of the gauge is mounted upon the balance. The armature is provided with two prongs arranged to engage the teeth of a notched wheel fixed upon the end of the aforesaid long screw so that the screw is revolved tooth by tooth with each complete movement of the armature.

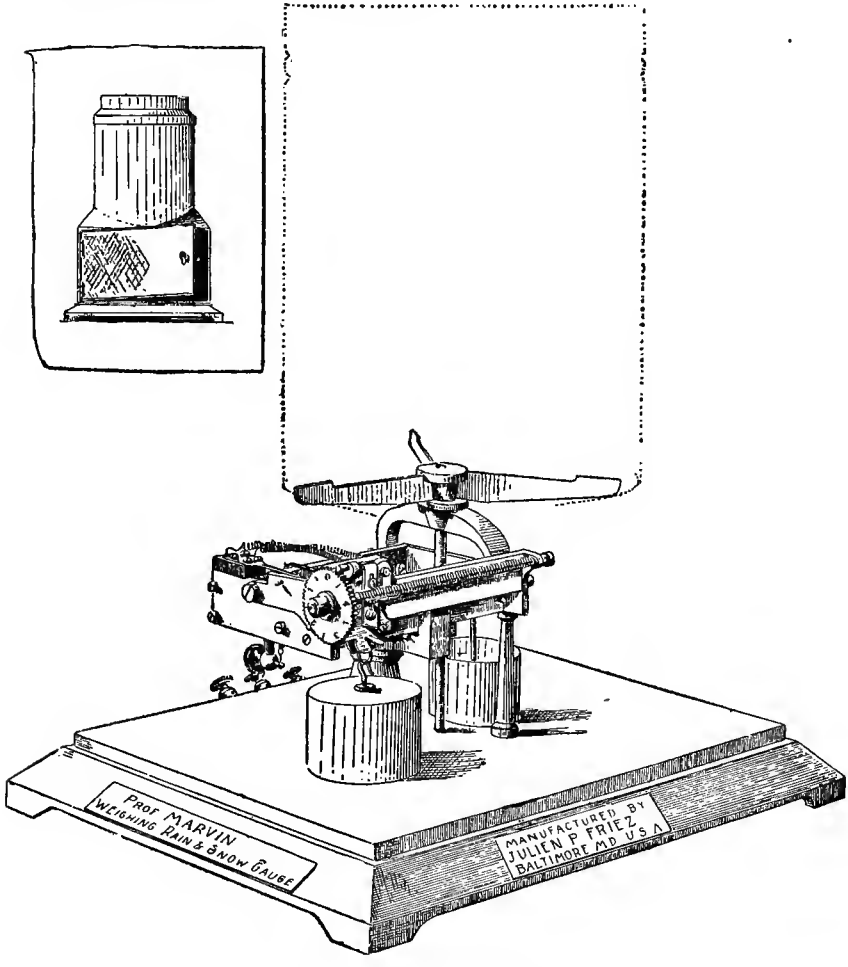

FIG. 1.—Weighing gauge.

7. To prevent the freely mounted balance from swinging up and down as well as to lessen or prevent the objectionable influence of the wind in disturbing suddenly the equilibrium of the balance, a dasher, submerged in a cup of oil or glycerine, is attached to the vertical stem forming the support for the copper can.

8. *The register.*—The register is shown in Fig. 2. The record cylinder is mounted upon a horizontal axis with the clock movement inside. The cylinder makes one revolution in twelve hours. The

mechanism giving motion to the pen consists of an electro-magnet and armature similar to those on the weighing gauge, and of a notched wheel fixed upon the end of a screw having cut upon it both a right and left handed thread of coarse pitch, viz., three threads to the inch. A cylindrical sleeve slides upon this screw, being guided by a slender rod below and parallel to the screw. A slender spring, with the recording pen attached to its point, is connected adjustably to the sleeve by a double friction joint which enables the pen to be set with great facility, the friction holding it accurately and firmly where placed.

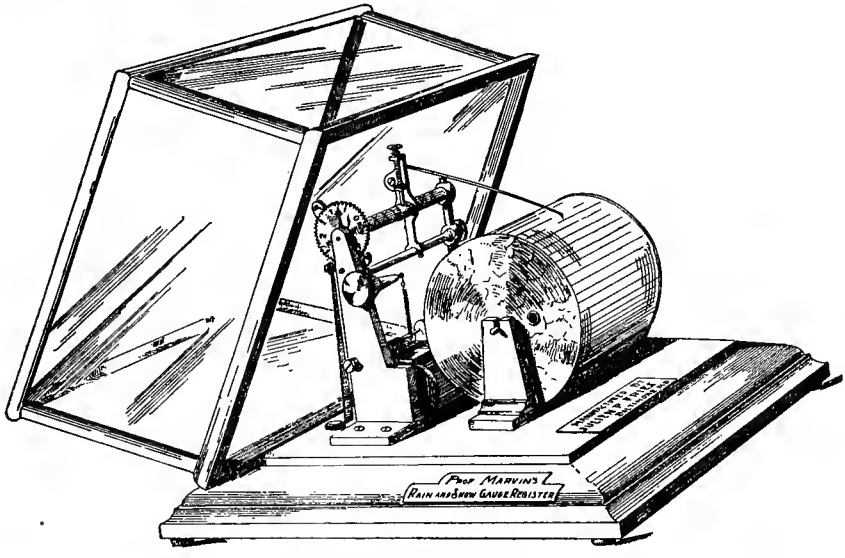

Fig. 2.—Register.

9. The armature of the electro-magnet engages directly the teeth of the notched wheel upon the right and left hand screw in such manner as to cause it to revolve tooth by tooth, always in one direction, with each vibration of the armature. The sleeve moving upon the screw is fitted with a crescent-shaped attachment which enters the thread of the screw. When the sleeve is set with the crescent in the thread at one end of the screw, the pen will, when the screw is revolved, be moved to the opposite end, the crescent-shaped piece being then guided into the other thread, and thus, upon continued rotation of the screw, causing the pen to return again to the starting point. Here the crescent nut will again pass into the thread first followed, and again carry the sleeve across the screw. The reciprocating motion of the pen thus secured is strictly in a straight line, and the subdivisions of the scale of the record sheet are equal throughout, conditions that are extremely desirable, especially in a recording rain gauge where rate of rainfall is to be obtained.

10. *Electrical details.*—The electrical connections and the interaction of the magnets will be learned from a study of Fig. 3.

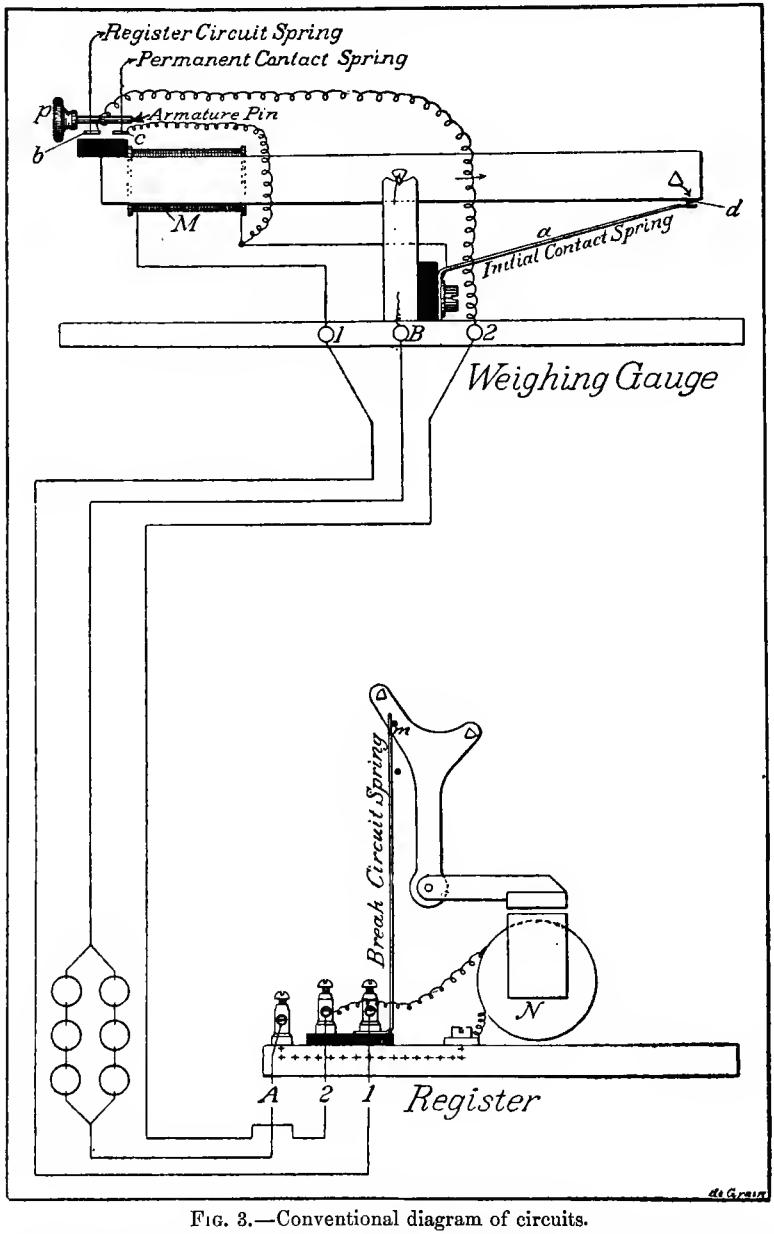

FIG. 3.—Conventional diagram of circuits.

11. Three wires and one battery are required. One pole of the battery is connected to the gauge at *B;* the other pole is joined to the register at *A*. The remaining posts are joined, No. 1 to No. 1, and No. 2 to No. 2.

12. The action is as follows: When the equilibrium is disturbed the circuit is closed at *d*. This contact is often light and momentary in character. The armature of the magnet, however, is free to move a short distance with only slight resistance, and a feeble contact at *d* is therefore sufficient to start the armature which, during this initial movement, closes a circuit firmly and permanently by contact of the pin *p* and the spring *c*, insuring thereby the complete attraction of the armature and a corresponding movement of the counterpoise. The armature also closes a second circuit at the register contact spring *b*. The current thereupon divides, part flowing through the magnet *M* on the gauge and an equal part passing through the magnet coil *N* on the register. When the armature of the register magnet has made its movement, the current through circuit No. 1 is interrupted at the contact pin *m*. This releases the armature of the magnet *M* on the gauge, and when said armature has returned to its normal position the circuits through the contact springs *c* and *b* are each broken. When the No 2 circuit through *b* is broken the register armature is released, closing again the No. 1 circuit at *m*.

13. If by these actions the equilibrium of the balance has been restored the contact at *d* will have been broken. If this is not the case, however, the cycle of actions will be repeated over and over again until the circuit is broken at *d*.

A single stroke of the magnet moves the sliding weight only one eight-hundredth part of an inch and represents one one-thousandth inch rainfall; that is, about $\frac{1}{40}$ of an ounce, or 0.82 gram. The record pen for one stroke of the magnet moves one one-hundred and fiftieth part of an inch; the scale of precipitation, therefore, is magnified $6\frac{2}{3}$ times. The pen will pass once across the sheet for each one-half inch of precipitation, and the sheet is subdivided to represent hundredths of inches of precipitation. The cylinder is 12 inches in circumference and revolves twice in twenty-four hours. The sheet is subdivided into ten-minute spaces, and intervals of one minute of time can be determined.

In the normal action of the gauge the electro-magnets rarely make more than one stroke to restore a condition of equilibrium, notwithstanding that this represents only one one-thousandth inch of rainfall.

14. *To set up gauge.*—Familiarity with the action of the gauge is best acquired by placing the two parts on short circuit.

15. In unpacking, remove carefully the material under the knife edges and see that they are properly seated and move freely. If necessary, adjust the dasher so that the disk is accurately centered in the cup, then pour into the latter enough of the oil or glycerine, sent with the gauge, to cover the disk about $\frac{1}{8}$ to $\frac{1}{4}$ inch. This should be poured in so as to run down the side of the cup and enter the space below the dasher. If this is not done a portion of air is apt to be imprisoned below the disk and interfere with proper action.

16. Hang the sliding counterweight on the ring at the bottom of the sliding carriage, and place the *lead* weight on the curved rod projecting from the beam at the left and back of the electro-magnet. The copper can is to be placed upon the three-pronged support at the right.

17. The sliding counterweight can be moved back and forth on the beam by catching, between the thumb and forefinger, the two pins projecting from the sliding carriage, just below the screw. A little pressure will disengage the nut from the screw, and the weight can then be moved and set as desired.

18. The middle binding post on the base of the gauge is uninsulated and therefore in electrical connection with all the uninsulated metal parts of the balance. The insulated binding post next toward the magnet end of the balance corresponds to the No. 1 post of weighing gauge, Fig. 3, and connects with the magnet coil. The remaining insulated post corresponds to post No. 2 of weighing gauge, and connects with the insulated armature spring *b*.

19. *Register.*—The clock movement of the register is within the cylinder and can be wound with the long key by inserting it in the hole found in one end of the cylinder. Access to the movement for regulation and other purposes is gained by opening the cylinder. First remove the record sheet; then the head of the cylinder can be taken out by uncoupling the bayonet joint by which it is secured. Care must be used in this manipulation to avoid injury to the delicate parts of the clock movement.

20. The recording cylinder should be placed in its supports so that the end of the axis having the thumbscrew is at the right, that is, farthest from the magnet. When placing the cylinder in position, the washer on the axis must come *between the screw and the support.* The cylinder will revolve only when the thumbscrew is tightened. After the thumbscrew is clamped, the cylinder is set at the correct time simply by revolving it the necessary amount against the gentle frictional resistance.

21. In placing the record sheet upon the cylinder, the top of the sheet must come at the end opposite the thumbscrew. The longitudinal lines of the sheet should be made to coincide as exactly as possible where the ends overlap, and the sheet held closely to the cylinder by a rubber band at each end. These bands must not be allowed to encroach upon the rulings of the sheet. The revolution of the cylinder carries the top part forward.

22. The clock movement must be wound each day.

23. The recording pen can be set at any desired point by lifting the crescent-shaped nut from the thread of the screw and moving the sleeve to any desired point, always, however, returning the nut to a thread of the screw. The notched wheel can be turned backward at any time by hand and advanced forward by alternately pressing and releasing the armature.

24. *To set the pen.*—Turn the notched wheel to zero, then shift the sleeve to the end of the screw next the notched wheel, dropping the crescent-shaped nut into the thread. By turning the pen spring in its bearings, set the pen point on the top line of the record sheet.

25. Only a gentle pressure should be brought to bear between the pen and the paper.

26. *Test and adjustment of gauge.*—Connect the gauge and register by three wires and a battery in the manner indicated in Fig. 3. The position of the lead counterweight should be so adjusted that with the can in position and empty, and with the sliding counterweight placed at the right end of the beam, the electric circuit will be closed at *d*, Fig. 3, and that several vibrations of the armature will be required to produce a condition of equilibrium. With some care a very nice adjustment of the lead counterweight can be made so that equilibrium will occur when the sliding counterweight is at the zero of the scale on the beam and the index points to the zero of the graduations on the notched wheel. While this adjustment is desirable it is not at all necessary, and even at best it is not certain that the zero on the notched wheel will always come exactly at the index. Equilibrium will often occur at a few notches either side of zero.

27. If the oscillation of the balance is not perfectly free, the most probable defect is in the adjustment of the dasher. The vertical stem to which the dasher is attached must necessarily have a small amount of lateral play and the disk of the dasher should be set so as not to touch the sides of the cup under any circumstances.

28. *Adjustment of contact springs b and c.*—When the gauges are first sent out from the central office no alteration should be made in these spring adjustments. In case, however, future adjustment is necessary it can be effected by turning the small screw with insulated head at the tip of the armature contact springs. Both springs are adjusted at the same time. The resistance offered by these springs must be kept as light as practicable, consistent with good electrical contact. The only purpose of the springs is to close electrical circuits; the spring for lifting the armature will be found at the back and below the beam. The adjusting screw at the point of the springs should be so set that a very small movement of the armature will cause the armature pin, *p*, to make contact with the spring, *c*. Contact is not made with both springs at the same time. The screw should be so adjusted that the movement of the armature is about half completed before contact is made with *b*. This tends to throw greater battery power on the magnet, *M*, and secures more positive action in the electrical mechanisms. The points of the springs must be *under the head of the adjusting screw.* The tension of the spring for lifting the armature must be carefully adjusted so that it *fully lifts the armature.* If the tension is too weak the armature pin, *p*, will make contact with *c*, and cause imperfect action. Excessive tension of the spring must be avoided.

29. *Adjustment of spring a.*—The initial contact spring must be set so that it will not be likely to touch the stop just underneath it except when depressed by the balance beam. If this spring accidently makes contact with the stop in question, the gauge will be short-circuited, and set in action just as if rain were falling.

30. *Adjustment of register.*—Little or no adjustment will ever be required of the parts of the register. The break-circuit spring should, when the armature of the magnet is *up*, rest in contact with the armature pin, and the adjusting screw with insulated head should be so set that the point of the spring will stop upon the insulation just before the armature completes its movement. The space between the pin and the spring when the armature is clear down should not exceed $\frac{1}{32}$ of an inch. The resistance offered by this spring should also be as small as is consistent with good contact.

31. The uninsulated binding post on the base of the register connects with one end of the magnet coil, and also through the metal of the various parts with the armature and contact pin. This is the battery post of the register. The insulated post in the middle corresponds to No. 2 (Register), Fig. 3, and connects with the remaining end of the magnet coil. The outer insulated post corresponds to No. 1 (Register), Fig. 3, and is connected with the break-circuit spring.

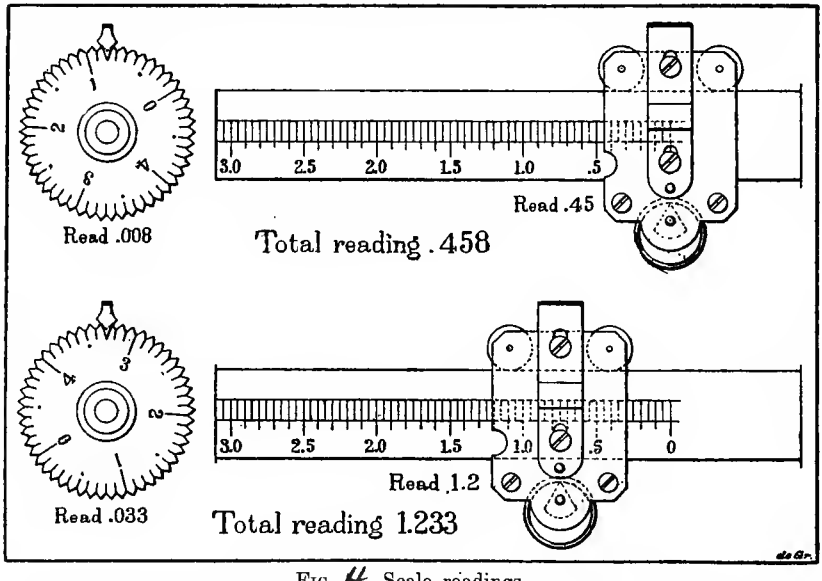

FIG. 4.—Scale readings.

32. When all the parts are in proper adjustment the gauge should respond regularly and continuously if water is caused to fall slowly and steadily into the copper can, either from a stopcock connected with the water supply or by slowly squeezing over the gauge a sponge saturated with water.

33. When the balance is forcibly depressed by hand, or if, with water in the can, the sliding weight is placed at the extreme right, the armatures should vibrate regularly and with considerable rapidity. To secure the best results the tension springs of the armatures may need to be regulated. A few trials, noting the effect of different tensions, will indicate the best adjustment.

34. *To read the graduations.*—The subdivisions of the scale on the beam of the balance represent 0.05 inch rain, and the graduations on the notched wheel are 0.001 of an inch rain. The conditions shown in Fig. 4 are read 0.458 and 1.233, respectively.

35. The graduations on the notched wheel of the register also represent 0.001 of an inch rain. The finest subdivisions on the record sheet represent 0.01 of an inch. When the pen of the register is properly adjusted its point should fall upon one of the ruled lines of the record whenever the index points to one of the numbered lines on the graduated wheel. The hundredths of inches are therefore read directly from the sheet, the thousandths may then be read from the wheel.

36. Some of the lines of the sheet are numbered from the top to the bottom, others from the bottom to the top. A half-inch of rain will carry the pen across the sheet and the next half-inch will be reckoned from the bottom upward, and so on, hence the double set of numbers.

37. *Explanation of record sheet.*—A single sheet is expected to contain the record for twenty-four hours. The pen is set at the top (at the left) and on the noon line when the sheet is changed. If rain does not fall in the first twelve hours, the pen will trace a line over the top line of the sheet. The twelve hours following the pen will, in case there is still no rain, retrace the same line. The record will always show, therefore, whether the rain occurred in the first or second twelve-hour period. If in the first, an ink line will extend only part way across the sheet, if in the second, there will be a continuous ink line clear across the sheet at the top, and the rain record will extend transversely across the sheet.

38. Fig. 5 shows a sample record. Two periods of rainfall are recorded. Rain began at 2.38 p. m. (note the absence of ink line at top of sheet after 2.38). From 2.38 to 2.57 the line inclines sharply across the sheet. This indicates a rather rapid rate of precipitation. After 2.57 the rain gradually ceases, stopping entirely by 3.30 p. m. The amount of rain up to this time is a little over 0.14 inch. Rain began again at 3 minutes past 10 p. m. The rate at first is less rapid in this case; it increases later, however, raining steadily as shown by the straightness of the line, until 11.20 p. m., continuing thereafter at a slower and less regular rate until 2.25 a. m., at which time rainfall ceased. The total rainfall is seen to be 0.50 (from top to bottom), plus 0.42 (from bottom upward) equals 0.92, total rainfall.

39. *Rate of rainfall.*—The rate of rainfall is shown by the inclination of the trace to the time lines of the sheet. One way of ascertaining the rate at any portion of the record is to prolong the trace by a pencil line and note the number of spaces crossed by the line from one hour line to the next. *Example:* To find the rate at the portion of the record marked *a*, prolong the trace as shown by the broken line. We find that this line crosses, in all, eleven spaces of the longitudinal rulings in the hour between 1 and 2; that is, the rate is 0.11 inch per hour.

40. A much better way of ascertaining rates is by the use of a rectangular plate of glass or transparent celluloid, having smooth edges and a few inclined lines scratched or engraved upon one face. This plate is laid over the record and one of its lines superposed exactly over the portion of trace where the rate is desired. Holding the glass in position, a straight edge is placed against one edge of the plate, which we now slide along the edge as a guide, so that the engraved line intersects, let us say, the top line of the sheet exactly at one of the hour lines. Following the engraved line across the sheet, with the eye, we note the number of longitudinal rulings crossed in one hour, or some convenient fraction thereof, as one-half hour,

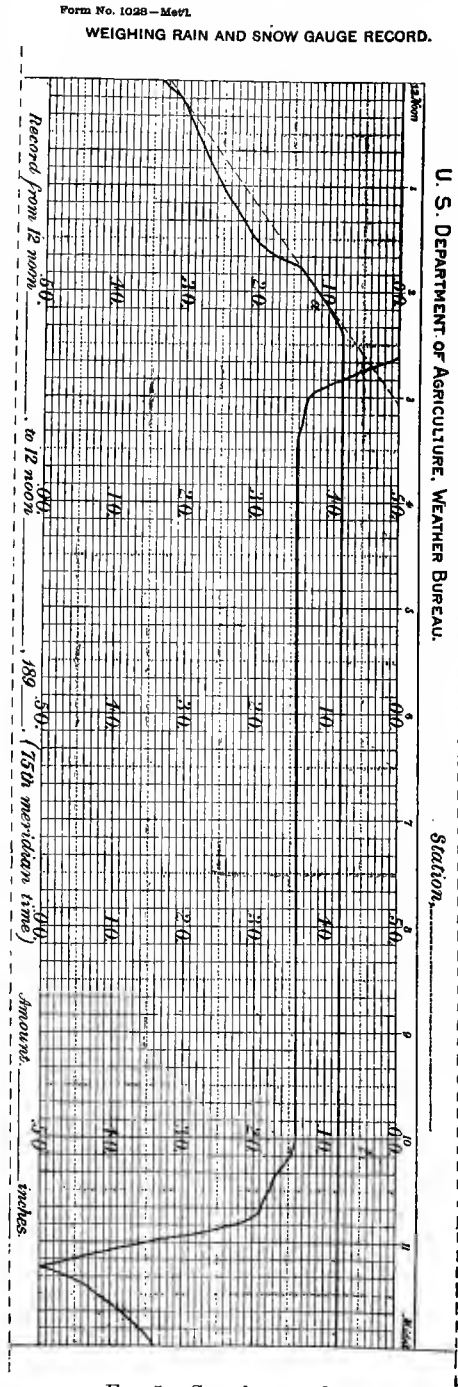

FIG. 5.—Sample record.

one-third hour, etc. The transparency of the plate renders the entire record visible and the ability to shift the line is very convenient and secures accuracy. By this device very rapid rates of rainfall can be picked out with precision, even when of comparatively short duration. The record, moreover, is not marred by the drawing of lines.

41. *Exposure of gauge.*—The weighing gauge should be given as nearly as possible the same exposure as the station gauge. The exposure should be selected with a view to satisfying the following conditions: The gauge should be sheltered as much as possible from very strong winds; at the same time, it should not be placed under the lee of a high wall, fence, or similar structure. If placed upon a roof, the latter should be large and flat and the gauge near the middle. A low wall, parapet, or balustrade in the vicinity of a gauge is not necessarily objectionable. The action of the wind by which the amount of rainfall caught by a gauge is effected is generally considered to be like this: The wind striking the straight sides of the gauge is broken up into eddies and deflected from its path so that a part passes up over the top of the gauge. These irregular currents and eddies catch the rain drops about to fall into the gauge, carrying at least a part of them over the mouth or entirely out of the gauge. The higher the wind velocity the greater the influence on the amount of rain collected.

42. *Evaporation.*—The only effect from evaporation in this gauge arises in the following manner: If rainfall occurs in the afternoon, for example, followed by clear skies and sunshine, so that the atmosphere is comparatively dry and the gauge becomes heated, more or less evaporation may occur. This, however, will have no effect whatever on the record of rain already made, but if rain occurs again during the night or the next day, the gauge will not begin to record until enough rain has fallen to make up the deficiency caused by evaporation. The amount in such a case is always very small.

43. For convenience, a small, low platform should be provided for the weighing gauge; 6 to 8 inches high is sufficient. This and the gauge upon it must rest without shakiness and be perfectly stable, otherwise wind or the walking about the gauge will disturb the equilibrium and cause small but objectionable errors in the record.

44. *Batteries.*—From four to six cells of battery are ample for this instrument, and they should be connected "two abreast." Three-wire cable will be used, generally, in connecting the gauge and receiver. The instructions given for the use of cables and setting of batteries in Circular D, Instrument Room, apply equally here.

45. *Cover of gauge.*—When permanently established, place in position the galvanized iron cover, removing first, if necessary, the copper can from the gauge and the brass ring section from the top of the cover. The can may now be placed upon the balance, taking care

that it is properly centered and does not touch the cover at any point; also that when the brass ring section is put in position the inner flange does not touch the copper can. Next set the sliding counterweight at the extreme right. This should so disturb the equilibrium that several vibrations of the magnet will ensue before equilibrium is established. *The gauge should always be adjusted to equilibrium by this process.*

46. *Funnel of receiver.*—The receiver of the gauge is provided with a detachable funnel-shaped bottom. This will be removed during the winter season so that snowfall can be collected. Its use at any time is somewhat objectionable, as the first portions of rainfall are retained upon it and do not at once reach the copper can. The advantage it offers, however, is the protection it affords against the wind blowing downward into the copper can so as to cause slight disturbances of the equilibrium. If an observer finds he can wholly dispense with the funnel without troublesome interference with his record, it is desirable he do so. The probable maximum wind effect will not greatly exceed 0.01 inch rainfall, but it prevents determining accurately the time of beginning and ending of precipitation.

SPECIFIC INSTRUCTIONS.

U. S. Department of Agriculture,
Weather Bureau, *Washington, D. C., October* 2, 1893.

The following instructions are issued for the guidance of observers in the care and use of the recording rain and snow gauge described in the text which precedes.

Mark W. Harrington,
Chief of Bureau.

47. The clock movement of the register will be wound at noon each day, and if necessary the clock set and regulated to correctly keep 75th meridian time.

Sheets will be changed at noon under the following provisions:

48. A new sheet being upon the register the observer will, *by actual trial and setting*, if necessary, be assured that the weighing mechanisms are in equilibrium, as explained in paragraph 45, the pen during this operation being lifted from the sheet. Equilibrium being established, the pen point will be adjusted to follow the top line of the sheet, the index pointing to zero on the notched wheel. (See paragraphs 24 and 25.)

49. If precipitation does not occur in the ensuing twenty-four hours, retain the sheet upon the cylinder and at noon set the pen at the tenth line, marked .10, on the form. This adjustment of the pen is to be effected by lifting the crescent-shaped nut from the thread of the screw and shifting the sleeve and nut the required distance, being careful not to move the pen laterally in its own bearings, and to enter the nut into the *left-hand* thread, that is, the one that will carry the pen toward the bottom of the sheet.

50. If twenty-four hours again pass without rainfall, the pen will be advanced to the .20 line on the sheet, and so on.

51. At the noon ending the sixth day without rainfall the pen will have traced the bottom line of the sheet and will then be removed and a new sheet started with the pen set at the top line. The several lines traced by the pen upon the sheet just removed will be separately and plainly marked, each with the day of the month of which it is the record of the absence of precipitation, the sheet being further dated and marked as called for by the blanks of the form.

52. At noon when precipitation has occurred, the pen will be lifted from the record sheet, making due note of the reading of the sheet and notched wheel; the gauge will be emptied and readjusted and the sheet changed, except as specified in paragraphs 53, 54, and 55. The sheet removed will be dated and the actual amount of precipitation entered in the blank space on the form. Whenever the precipitation is in the form of snow, this circumstance will be appropriately noted on the face of the record.

53. When rain or snow, already partly recorded, is falling heavily at noon the sheet will be allowed to run another day without resetting the pen or emptying the gauge.

54. When it is raining lightly, or upon rainy, wet days when precipitation is probable at any time, the sheet will be changed at noon, but the gauge will not be emptied except it contains a large quantity of water and there is danger of losing record by the weighing limit of the gauge being surpassed. The limit is about 3 inches of rain. The gauge in such an emergency may be emptied at any time, and if possible, readjusted during a cessation of rainfall, always entering an asterisk and explanatory footnote at the break in the continuity of the record necessarily occasioned.

55. When for any reason the gauge is emptied at any hour other than noon, first make note of the reading of the notched wheel of the register. Lift the pen from the sheet *without moving it laterally*, and readjust the gauge. The sheet will not be changed in this emergency, but turn the notched wheel to the same graduation as before and, by shifting the sleeve, set the pen on the line previously traced; or, if the gauge must be emptied during the rain, set the pen so as to trace the most probable continuation of the preceding record. Explanatory footnotes will be entered in all such cases.

56. When the gauge is about to be emptied after rainfall, the observer will ascertain, by pressing upon the balance with the finger, whether it is in equilibrium or not. When any suspicion exists that the amount of rain recorded is not correct, the observer will measure the water in the can by pouring it into the measuring tube of the station gauge.

57. At noon each day, after the absence of rainfall, the observer will note the reading of the notched wheel in case said wheel does not stand at zero as set the day before, and he will take such action as may be necessary both to readjust the gauge and to ascertain and eliminate the cause of the disturbance.

58. If the accidental disturbance of the equilibrium is sufficient to show upon the sheet, proper footnote will be made in explanation.

59. Whenever the equilibrium is accidentally disturbed sufficient to show upon the sheet, the gauge will be readjusted as soon as the fact is discovered, setting the pen at the proper line and the notched wheel at zero.

60. *Before leaving the gauge after readjustment secure the iron cover firmly to the base by the hooks provided, and latch the door.*

61. A thorough test of the condition of the gauge, batteries, etc., will be made at least once each week. During the test the pen will be lifted from the sheet. Dust and foreign matter that may lodge on the balance, especially the beam traversed by the sliding weight, should be removed with a rag moistened with a little oil. Slide the carriage back and forth to see that it is free.

62. The right and left-hand screw of the register and the guide rod should also be occasionally wiped clean with a rag *slightly* moistened with oil.

63. Electrical contacts will be examined and kept bright and clean.

64. Instructions in Circular A, Instrument Room, pertaining to the use and a care of register pens, ink, etc., apply equally here.

65. If glycerine is used in the dash pot it will sometimes deteriorate by absorption of water during prolonged damp weather. If the glycerine does not properly perform its functions, the dasher can be removed, the cup emptied, and refilled with new glycerine.

66. The data compiled from the record sheet after each rainfall will be such as required by the blanks of Forms Nos. 1017 and 1028, and such others as may hereafter be provided.

67. Until Form No. 1040 (Hourly precipitation readings) is received enter data from Form No. 1028 on Form No. 1017, as heretofore, from the float recording gauge.

68. Stations receiving the new weighing gauge will discontinue the use of the old float recording gauge when the weighing gauge is in successful operation.

O